REMARKS/ARGUMENTS

Upon entry of the instant amendment, claims 1-5, 7-11, 13-15, 20, 22, 23, 25 and 26 will be amended, and claims 27-39 will be added, whereby claims 1-39 will be pending. Claims 1 and 25 are independent claims.

Reconsideration and allowance of the application are respectfully requested.

Response to Formal Matters

Applicants express appreciation for the acknowledgment of the claim of priority as well as receipt of the certified copy of the priority application in this national stage application.

Applicants also express appreciation for the return of the initialed Form PTO-1449, whereby the Examiner's consideration of Applicants' disclosure statement filed February 11, 2002 is of record.

Response To Objection To Specification

In response to the objection to the Abstract, the abstract has been canceled and a new Abstract submitted in its place wherein the Abstract is presented in one paragraph. Moreover, "said" has been changed to ---the--- in the Abstract.

Accordingly, this ground of objection should be withdrawn.

Response To Objection Of The Claims

In response to the objection to the claims, the claims have been amended herein to avoid

the use of expressions, such as "preferably" and "particularly". Moreover, additional amendments have been made to the claims to present their recitations even more in accordance with idiomatic English and to generally improve the form of the claims..

Still further, the claims and specification have been amended to indicate HAAKE™. Applicants note that the disclosed and claimed HAAKE™ Rheometer, RS 100 is an instrument that is known to one having ordinary skill in the art, and no further description thereof appears to be needed.

Accordingly, these grounds of objection should be withdrawn, and no estoppel should be deemed to be associated with the amendments herein.

Response To Rejection Under 35 U.S.C. 101

In response to the rejection of claims 25 and 26 under 35 U.S.C. 101, Applicants respectfully submit the following.

By the present amendment, claims 25 and 26 have been amended to be more in accordance with U.S. practice by reciting a process as compared to a use. Accordingly, this ground of rejection should be withdrawn., and no estoppel should be deemed associated with the amendment.

Rejections Based Upon Prior Art

Claims 1-24 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Doherty et al. (hereinafter "Doherty"), U.S. Patent No. 5,607,716.

The rejection contends that Doherty teaches the various components of Applicants' food composition. The rejection then contends that the claims appear to differ as to the gelation temperature but considers this to be inherent or obvious in view of Doherty.

In response, Applicants remind the Examiner that Doherty was cited during international examination. In particular, during international examination, the Written Opinion made a similar rejection over Doherty. However, upon consideration of the arguments presented in response to the Written Opinion, novelty was indicated in the International Preliminary Examination Report for the claimed invention because claim 1 defines a food composition comprising 50-70% soluble solids, of which at least 70% comprise sweeteners in which at least 5% are non-sucrose sweeteners with a DE value of at least 30, carrageenan and water, whereby the gelation temperature determined by the intersection of the elastic and viscous modulus is below 95°C. Moreover, the International Preliminary Examination Report indicated that the claims had inventive step over Doherty.

The rejection does not address any aspect of the arguments presented during the International phase of the present application, nor does the rejection comment on the remarks made by the International Preliminary Examination Authority.

For the Examiner's convenience another copy of the Reply to the Written Opinion dated May 4, 2001 (which was submitted when entering the national stage) is submitted herewith including Appendices I - III. As can be seen from the second page of the Reply, Applicant responded to the Examiner's statement that the "gelation temperature is a consequence of the composition, thus a

value below 95°C would be obtained." In particular, it was pointed out that Applicants have repeated example 1 of D1 (regular caramel) referring to Appendix I. It was pointed out that:

> As it appears from the enclosed photographs from the production process, the viscosity of the caramel composition is adequately low at 116°C. However, upon cooling to 95°C the viscosity increases excessively and the composition cannot be deposited in moulds at 95°C to obtain an acceptable final product.
>
> From the enclosed graphs of elastic modules, G', and viscous modulus, G", of the composition according to example 1 of D1, cf. Appendix I(4), it furthermore appears, that said two graphs do not intersect at a temperature of <95°C, which means that the gelation temperature, determined as the intersection of the graph G' and G", cf page 7, lines 11-13 in the specification, is >95°C

Still further, in correspondence dated August 2, 2001 (also submitted when entering the national stage and another copy submitted herewith), Applicant indicated that:

> Finally, I can inform you that in the comparative examples forwarded with my reply to the Written Opinion dated 4 May 2001 the same settings of the rheology measurement as used in the application were applied.

Applicants further remind the Examiner that in order for inherency to be present the Examiner has the burden of showing that the result indicated by the Examiner is the necessary result, and not merely a possible result. In re Oelrich, 212 U.S.P.Q. 323 (CCPA 1981); Ex parte Keith et al., 154 U.S.P.Q. 320 (POBA 1966). The fact that a prior art article may inherently have the characteristics of the claimed product is not sufficient. Ex parte Skinner, 2 U.S.P.Q.2d 1788 (BPAI 1986).

As the Board of Patent Appeals and Interferences states in Ex parte Levy, 17 U.S.P.Q.2d 1461, 1463:

> However, the initial burden of establishing a prima facie basis to deny patentability to a claimed invention rests upon the examiner. In re Piasecki, 745 F.2d 1468, 223 USPQ 785 (Fed. Cir. 1984). In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. In re King, 801 F.2d 1324, 231 USPQ 136 (Fed. Cir. 1986); W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983); In re Oelrich, 666 F.2d 578, 212 USPQ 323 (CCPA 1981); In re Wilding, 535 F.2d 631, 190 USPQ 59 (CCPA 1976); Hansgirg v. Kemmer, 102 F.2d 212, 40 USPQ 665 (CCPA 1939).in order for inherency to be present it must be a necessary result, and not merely a possible results. Ex parte Keith and Turnquest, 154 U.S.P.Q. 320 (B.O.A. 1966).

In the instant situation, the rejection has merely asserted that the gelation temperature is a consequence of the composition and thus a value below 95°C would be inherent and/or obvious to that of Doherty. However, the rejection does not provide any support for establishing that the gelation temperature is a necessary consequence of the composition.

For the reasons set forth above, the anticipation rejection is without appropriate basis, and should be withdrawn.

Moreover, with respect to the obviousness rejection, it is noted that the rejection is silent with regard to any modification of Doherty to arrive at Applicants' disclosed and claimed invention. Accordingly, the rejection is without appropriate basis. In this regard, in the event that the rejection is maintained, the Examiner is respectfully requested to set for the how Doherty is being modified and where there is motivation in the prior art to make an asserted modification of Doherty. Of course, if

upon further review, an obviousness rejection is made, Applicants expect that the that rejection would not be final.

Therefore, the anticipation and obviousness rejections should be withdrawn.

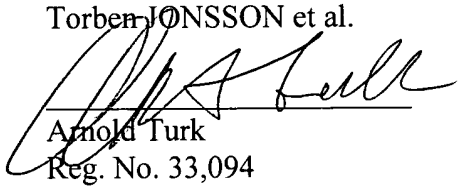
CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the objections of record, and allow all the pending claims.

Allowance of the application is requested, with an early mailing of the Notices of Allowance and Allowability.

If the Examiner has any questions or wish to further discuss this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.

Respectfully submitted,
Torben JONSSON et al.



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4 May 2001

Dear Sirs

COPY

International patent application No PCT/DK00/00252
Applicant: Hercules Incorporated
My ref: 72201 UCK/MSH

I refer to the Written Opinion dated 5 February 2001 and have the following comments thereto:

Claim amendments:

Claim 1 has been restricted by the introduction of part of present claim 4 into claim 1 to limit the DE of the non sucrose sweetener to the range of about 50 to about 90, and present claims 2 and 3 have been deleted.

Present claim 6, now claim 4, has been clarified by indicating that merely the sucrose component, if any, and not the non sucrose sweeteners may be replaced wholly or partly by an aqueous solution of a sugar alcohol.

Finally the remaining claims have been renumbered.

Amendments to the specification:

The specification has been adapted to the claim amendments specified above, cf amended sheets 7, 8, 9, 10, 15, 36, and pages 22-23 have been deleted. Furthermore figures 1.3, 1.4 and 1.6 have been deleted.

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Prior art:

D1

US 5,607,716 (Doherty et al.), D1, example 1 discloses a caramel composition comprising 53% soluble solids, of which 84% are high fructose corn syrup, 0.45% carrageenan, and water. D1 is silent on the DE (Dextrose Equivalent) of the non sucrose sweetener employed.

The Examiner states that the "gelation temperature is a consequence of the composition, thus a value below 95°C would be obtained." This is, however, not correct.

The applicant has repeated example 1 of D1 (regular caramel), cf. Appendix I.

As it appears from the enclosed photographs from the production process, the viscosity of the caramel composition is adequately low at 116°C. However, upon cooling to 95°C the viscosity increases excessively and the composition cannot be deposited in moulds at 95°C to obtain an acceptable final product.

From the enclosed graphs of the elastic modules, G', and viscous modulus, G", of the composition according to example 1 of D1, cf. Appendix I (4), it furthermore appears, that said two graphs do not intersect at a temperature of $<95°C$, which means that the gelation temperature, determined as the intersection of the graphs of G' and G", cf page 7, lines 11-13 in the specification, is $>95°C$.

Consequently D1 does not anticipate the present invention.

D2

WO 98/20860 (FMC Corporation), D2, example 1 discloses a composition with 79.5% soluble solids, of which 98% (and NOT 84%) are sucrose and corn syrup in a weight ratio of 45:55 sucrose: corn syrup, said syrup having a DE of 43/43, carrageenan, and water.

Example 1 of D2 was repeated, cf. Appendix II.

As it appears from the enclosed photographs from the production process depositing even at a temperature of 102°C was difficult and the final product possessed an unacceptable appearance.

It furthermore appears from the enclosed graphs of G' and G" of the composition according to example 1 in D2, cf. Appendix II (3), that there is no intersection of G' and G" at a temperature <95°C, which means that the gelation temperature of said composition is >95°C.

In order to verify that the calcium carbonate component in example 1 of D2 is not the determining factor for the behaviour of the composition, example 1 of D2 was repeated, however without addition of any $CaCO_3$. The result of said test is shown in Appendix III. As it appears, it was not possible to obtain an acceptable product even by depositing at 98°C.

It furthermore appears from the enclosed graphs of G' and G", that the gelation temperature is higher than 95°C.

Thus D2 does not anticipate the present invention.

The present inventors were thus the first to realize that by employing a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the Dextrose Equivalent (DE) of the non sucrose sweetener is about 50 to about 90, it is possible to dissolve a carrageenan component in a high solids system of about 50 to about 90% by weight of soluble solids in a minor amount of water to obtain a food composition having a gelation temperature of less than 95°C. Gelation temperatures of above 95°C are undesirable from a practical point of view, necessitating special precautions to be taken. Furthermore comparatively smaller amounts of water need to be added compared to conventional processes and consequently less energy is needed for the subsequent evaporation thereof. The present invention thus represents a substantially increased process efficiency.

Nothing in the prior art would lead the skilled man to realize which features are necessary in order to arrive at a high soluble solids system comprising a sweetening system, a carrageenan component and water having an adequately low gelation temperature.

The Examiner states that independent claim 20, now claim 18, is not novel in view of D1. However, according to D1 a blend of liquified corn syrup and dry sugars is prepared and heated in a first step, whereas according to the invention any sucrose in the composition is not added until after heating the syrup.

Finally independent claim 25, now claim 23, is not anticipated by D2. Thus as shown in Appendix II and contrary to the opinion of the Examiner a gelation temperature of below 95 °C is not obtained by the composition of example 1 in D2.

In view of the above the Examiner is respectfully requested to acknowledge the patentability of the present invention.

Furthermore please be informed that in the measurement method disclosed on page 30 a Haake Rheometer, RS100, Rheostress was used, measurements being performed at the indicated oscillating rate of 0,4640 Hz and at a variable stress. Please let me know if any further information in this regard is needed.

Please note, however, that should the Examiner still have any objections to the claims as now set forth, the Applicant is very willing to come to an interview in order to clarify any unsettled questions.

Yours faithfully

CHAS. HUDE A/S

Ulla C Klinge

Representative of the Applicant

Encs: New copy pages 7-11, 15, and 22-38 of the specification
New copy of the claims (pages 39-42)
Draft copy of pages of the specification, claims and figures
Appendix I
Appendix II
Appendix III
EPO Form 1038

viscosity during depositing in e.g. moulds, gels rapidly and can successfully be produced at temperatures not requiring special apparatuses or arrangements to be met.

In its first aspect, the present invention relates to a food composition comprising soluble solids in the range of 50% to 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE (Dextrose Equivalent) of about 50 to about 90, a carrageenan component in an amount sufficient to form a gel, and water to balance,wherein the gelation temperature, determined as the intersection of the graphs of elastic modulus, G', and viscous modulus, G", of said composition is < 95°C.

The elastic modulus, G', indicates the solid behaviour of a gel, and is a measure of the gel strength, while the viscous modulus, G", indicates the liquid behaviour of the gel, which correlates to the degree of bounciness and trembling of the gel.

In a second aspect, the present invention provides a process for producing a food composition as defined above comprising (a) dispersing carrageenan in a syrup of a non sucrose sweeetener at a temperature sufficient to disperse the carrageenan in said syrup while stirring, (b) adding water and heating the mixture to the boiling point thereof, (c) adjusting the soluble solids content to from about 50% to about 90% by weight, (d) depositing said mixture, and (e) cooling said mixture to below the depositing temperature of said mixture.

As used herein, the term "depositing temperature" means the lowest temperature, at which depositing is possible, i.e. at which temperature the food composition is still flowable, such as through a "Mogul" plant or depositor.

In a third aspect, the present invention provides the use of a carrageenan component for gelling a food composition of a soluble solids content of about 50 to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE of about 50 to about 90, and wherein the gelation temperature of said composition is < 95°C.

Brief Description of the Drawing

The invention is described in more details with reference to the accompanying drawing, wherein

Figs 1.1 to 1.9 illustrate viscosity, elastic modulus, G', and viscous modulus G", versus temperature for food compositions produced according to example 8, and

Fig 2 illustrates viscosity, elastic modulus, G', and viscous modulus, G", versus temperature for food compositions I, II and VI according to Example 9.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the scope of the invention will become apparent to those skilled in the art from this detailed description.

Best mode for carrying out the invention

The food composition according to the invention in a preferred embodiment comprises a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweetener of 0:100 to 95:5, wherein the non sucrose sweetener is a hydrogenated starch hydrolysate syrup of a DE of about 60 to 70.

In another preferred embodiment of the present invention, said non sucrose sweetener is a non sucrose sweetener with a maltose content ≥ 50% and a DE of about 50 to 60. Said embodiment provides the optimum characteristics in terms of sweetness level, texture and solubility of the gelled food composition.

As used herein, the term "DE" stands for "Dextrose Equivalent". DE indicates the degree to which a carbohydrate starting material has been decomposed to dextrose.

Thus, it has been found that at DE values below about 50, the carrageenan employed will swell excessively, leading to excessive gelling causing a gelation temperature well above 100° C. However, gelation temperatures of above 100° C are undesirable from a practical point of view, necessitating special precautions and requirements in terms of e.g. apparatus.

By employing the above mentioned sweetening system, it has, however, surprisingly been shown that it is possible to dissolve a carrageenan component in a high solids system of about 50 to about 90% by weight of soluble solids using a minor amount of water. A particular advantage of the present invention is thus the fact that the amount of water added can be limited compared to a conventional process whereby less energy is needed for the subsequent evaporation thereof to obtain a final product of a desired soluble solids content. The present invention thus represents a substantially increased process efficiency.

In another embodiment of the present invention, the sucrose can be replaced wholly or partly by an aqueous solution of a sugar alcohol. Said sugar alcohol is preferably, but not exclusively, selected among sorbitol, mannitol, xylitol, isomalt, lactitol, maltitol or a maltitol syrup.

In a preferred embodiment of the present invention, the sweetening system comprises sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweetener of from about 10:90 to about 70:30, preferably from about 20:80 to about 30:70, particularly preferred about 1:2. Thus, it has been found that at the disclosed ratios, an acceptable sweetness level still providing a composition having a gelation temperature of $< 95°$ C is obtained.

Particularly preferred, the gelation temperature of said food composition is $< 85°$ C, preferably $< 80°$ C.

The present invention is highly suitable for preparing gelled food compositions having high soluble solids content. In a preferred embodiment, said soluble solids content is in the range of 70 to 85% by weight, particularly preferred about 75 to 80% by weight.

Advantageously, at least about 80%, preferably at least about 90% of the soluble solids are comprised by the above sweetening system. Thus, it has been shown that even at such high concentrations of sweetening system a gelled product having a satisfactory gelation temperature may be obtained.

As carrageenan component an iota carrageenan or a kappa carrageenan or mixtures thereof are employed, preferably in an amount of about 0.25 to 10.0% by weight, preferably about 0.75 to 5.0%, especially about 1 to 3% by weight of the food composition. Suitable carrageenans are commercially available as e.g. GENUTINE™ type X-8300, X-8302, and X-9303 from Hercules Copenhagen, Denmark, or GENU-

GEL™ type WR-713 or X-8605, likewise available from Hercules Copenhagen.

While the above carrageenans are the preferred ones, it must be understood that the invention is not limited thereto. Thus, any carrageenan component, which will provide the required gelling capability, may be employed in a food composition according to the present invention. More particularly, a carrageenan component in a non-purified form, such as in the form of seaweed, particularly red seaweeds, may also be employed.

Further, one or more additional hydrocolloids may be employed in combination with the above disclosed carrageenans to provide a particular gelling property, such as pectin, e.g. GENU™ Pectin, available from Hercules Copenhagen, agar-agar, e.g. GENU™ Agar, available from Hercules Copenhagen, cellulose, such as AVICEL™, cellulose extracts and derivatives such as carboxy methyl cellulose (CMC), e.g. Blanose cellulose gum, methyl cellulose, e.g. Benecel™, hydroxy propyl cellulose, e.g. Klucel, hydroxy propyl methyl cellulose and mixtures thereof, starch, such as Avebe ™ Perfectagel MPT, Avebe ™ Perfectagel 928 and Avebe ™ Perfectamyl Gel MB, alginates, xanthans such as Keltrol or Kelgum from Kelco Biopolymers, curdlan, gelatine, guar, locust bean gum, tara gum, karaya gum, gellan gum such as Kelcogel from Kelco Biopolymers, furcellaran, tragacanth, and gum arabic, generally in an amount of up to about 10% by weight.

04.05.2001

The present invention also provides the use of a carrageenan component for gelling a food composition of a soluble solids content of about 50 to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE of about 50 to about 90, and wherein the gelation temperature of said composition is below 95°C. The carrageenan component is preferably an iota carrageenan or a kappa carrageenan or mixtures thereof.

Thus, a vegetable alternative to gelatine has been provided giving a product of a similar texture as gelatine gelled products and which allows the preparation of food compositions of high soluble solids content in a cost and energy efficient, industrially applicable process.

Examples

In the examples given below the following apparatus and chemicals have been used to prepare and test food compositions according to the invention:

Apparatus:

- Texture Analyzer, TA-XT2. 5 kg. Software Texture Expert™, manufactured by Stable Micro Systems, England.

Chemicals:

- Sucrose, food grade, Danisco A/S, Denmark
- Citric acid, monohydrated, MERCK in 50% w/v solution
- Tri-sodium citrate, $2H_2O$, MERCK
- GENUTINE™ types X-8302, X-8300, and X-9303 carrageenan, Hercules

Example 6.1

Preparation of an aerated food composition (marshmallows)

Aerated confectioneries (marshmallows) were produced according to the following table:

Table III

Component	Ingredients	% SS	(g)	(g) SS
A	Water	-	16.00	-
	Sucrose	100	46.00	46.00
	Glucose syrup (DE-39)	84	18.00	15.12
	Invert syrup	75	19.00	14.25
B	Water	-	13.50	-
	GENUTINE™ type X-8300	100	1.12	1.12
	GENU™ Agar type 900-A1	100	0.45	0.45
C	Water	-	6.50	-
	Icing sugar	100	3.00	3.00
	Hyfoama™ DSN	100	0.40	0.40
D	Flavour and colour		Optional	
	Evaporation		23.97	
	Yield		100.00	
	Yield soluble solids			80.34

A sugar syrup is prepared by mixing the components (A) and heating to the boiling point. Separately a dispersion of carrageenan and a further hydrocolloid in the form of GENU™ type 900-A1 agar is dispersed in 90° C water (Component B) while stirring with a high speed mixer for two minutes. Component (B) is added to component (A) and boiled to 86% of soluble solids. Separately therefrom the ingredients of component (C) are mixed and beaten to a stiff foam.

The mixture of component (A) and (B) is slowly added to component (C) while whipping and beating for about three minutes at high speed.

Thereupon, optional flavour and colour are added, and the slurry is deposited immediately in a hot state in a manner analogous to example 1.1.

Example 7.1

Preparation of a high sugar glazing

A high sugar glazing was produced according to the following table.

Table IV

Component	Ingredients	% SS	(g)	(g) SS
A	GENUGEL™ type X-8605 carrageenan	100	0.4	0.4
	Sucrose	100	4.0	4.0
	Tri-sodium citrate	100	0.6	0.6
B	Water	-	18.0	-
C	Sucrose	100	20.0	20.0
D	Glucose syrup**	80	60.0	48.0
E	Potassium sorbate 20% w/v	20	0.5	0.1
F	Citric acid 50% w/v	50	1.4	0.7
	Evaporation		4.9	
	Yield		100.0	
	Yield soluble solids			74.0

** Cerestar FT 01700.

The ingredients of Component (A) are dry-blended and dispersed in component (B) and heated to boiling to dissolve the carrageenan. Component (C) is added while heating, whereupon Component (D) is mixed thereto under continued heating. The heating is continued to obtain a soluble solids content in the range of 73 to 75%, whereupon Component (E) as a preservative and Component (F) as a buffer is added. The composition is deposited as disclosed in example 1.1.

The texture of the above food composition is short, creamy and very transparent. It can be melted without dilution by heating to 60 to 70° C. However, it may also be diluted by about 20% of water to obtain a glazing suitable for fruit and ice cream tarts.

04 05 2001

Examples 7.2 to 7.4

Further glazing compositions were produced analogously with the above disclosed procedure. The recipes used appear from the below table V.

Table V

Component	Ingredients	Ex. 7.2			Ex. 7.3			Ex. 7.4		
		% SS	(g)	(g) SS	% SS	(g)	(g) SS	% SS	(g)	(g) SS
A	GENUGEL™ type X-8605 carrageenan	100	0.4	0.4	100	0.4	0.4	100	0.4	0.4
	Sucrose	100	4.0	4.0	100	4.0	4.0	100	4.0	4.0
	Tri-sodium citrate	100	0.6	0.6	100	0.6	0.6	100	0.6	0.6
B	Water	-	20.0	-	-	17.0	-	-	15.0	-
C	Sucrose	10.0	17.0	17.0	100	22.0	22.0	100	27.0	27.0
	Glucose syrup*	80	60.0	48.0	80	60.0	48.0	80	60.0	48.0
D	Citric acid 50% w/v	50	1.4	0.7	50	1.4	0.7	50	1.4	0.7
	Evaporation		3.4			5.4			8.4	
	Yield		100.0			100			100	
	Yield soluble solids		70.7				75.7			80.7

* CERESTAR FT 01700

The texture of the products of ex. 7.2 to 7.4 is pleasantly soft, creamy and short.

Test results of the above compositions appear from the table VII below.

Experimental results

Measurement methods:

Texture, pH and content of soluble solids are determined as follows:

Texture

The textures of the deposited samples are characterised by the following parameters: Break strength (BS) (in grams of force), at 5°C, Gel strength (in grams of force), at 5°C at a 2 mm, 4mm, and 8 mm compression distance, and Distance to break (DT) at 5° C, which parameters are measured with a Texture Analyzer on test samples deposited in Bloom glasses.

Bloom glasses: Pyrex™ glass cylinders of a diameter of 700 mm and a height of 40 mm, available from Bibby Sterilin Ltd., Stone, Staffordshire, Great Britain.

Break strength.

The Break strength (BS) is determined as the force (in grams) required to compress the sample to break with a 0.5" (1.25 cm) diameter probe.

Gel strength.

The Gel strength is determined as the force (in grams) required to compress the gel 2, 4, and 8 mm, respectively, with a 0.5" (1.25 cm) diameter probe.

Distance to break.

The Distance to break (DT, Distance Travelled) is determined as the distance (in mm) it takes to break the gel.

In these experiments the probe speed is 1 mm/sec.

Refractometer.

Part of the gel from one of the Bloom glasses is used for measurement of soluble solids in a refractometer, available from Bellingham & Stanley Ltd., Great Britain, covering the range 40 to 80% SS or 75 to 93% SS.

Depositing temperature.

Said temperature is measured with a thermometer placed in the centre of a depository funnel. The depositing temperature is read as the temperature just before the material is non-flowable.

Gelation temperature.

The gelation temperature, T_{gel}, is the temperature at which the gel-forming process initiates. It is determined as the intersection of the graphs of elastic modulus, G', and viscous modulus, G", respectively.

Rheological measurements: Rheological measurements to determine the elastic modulus, G', the viscous modulus, G", as well as the viscosity versus temperature were performed using a Haake Rheometer, RS100, Rheostress, Haake, Germany.

Measurements were performed using the following settings:

-Gradient 1°C/min, 0,4640 Hz

95°C-65°C, t=1800 s, 0,50 Pa

65°C-35°C, t=1800 s, 2,50 Pa

-Stress sweep 35°C

0,10 Pa-20;00 Pa, 0,4640 Hz

Springiness.

Springiness is a measure of the ability of the sample to regain its original shape after compression. The sample is placed under a cylinder probe, avoiding any irregular or non-representative areas. The probe then compresses the sample until it has compressed 20% of the product height. The probe holds this position for 60 seconds and then withdraws from the sample and returns to its starting position. The force on the probe after 60 seconds at the 20%-position is recorded (F 60). % springiness is calculated from the expression:

$$\% \text{ springiness} = \frac{F\,60}{F_o} \times 100\%$$

wherein F_o is the force measured after 0 seconds.

Test results for examples 1.1 to 4.4 and 7.2 to 7.4 appear from the below Tables VI and VII, respectively.

Table VI

Test results for examples 1.1 to 4.4, soft candies (wine gums)

		Ex. 1.1	Ex. 1.2	Ex. 2.1	Ex. 2.2
% SS (calculated)		60	70	60	70
Sucrose:Non sucrose		60:40	60:40	20:80	20:80
DE of non sucrose		~DE 60	~DE 60	DE 60	DE 60
TA.XT2 measurements in Bloom glasses					
Gel strength	2 mm (g)	6.7	6.8	6.0	6.9
	4 mm (g)	15.3	16.2	14.1	16.3
	8 mm (g)	40.0	41.2	37.2	41.0
BS (g)		739	873	660	830
DT (mm)		29.6	29.8	29.3	30.0
Depositing temperature (°C)		74-76	84-86	76-78	84-86
pH		3.8	3.8	3.8	3.9
% SS (measured)		60.0	70.0	60.0	67.0

Table VI (cont.)

		Ex. 3.1	Ex. 3.2	Ex. 3.3	Ex. 4.1	Ex. 4.2	Ex. 4.3	Ex. 4.4
% SS (calculated)		60	70	80	60	70	80	85
Sucrose:Non sucrose		20:80	20:80	20:80	20:80	20:80	20:80	20:80
DE of non sucrose		DE 95	DE 95	DE 95	DE 60	DE 60	DE 60	DE 60
TA.XT2 measurements in Bloom glasses								
Gel strength	2 mm (g)	9.3	8.1	8.8	298	347	194	118
	4 mm (g)	18.8	17.6	19.2	623	706	546	379
	8 mm (g)	44.1	42.8	45.2	254	395	1335	1234
BS (g)		453	555	714	417	534	1403	2140
DT (mm)		26.4	27.1	30.0	27.4	29.2	9.1	14.1
Depositing temperature (°C)		67-69	74-76	86-88	53	63	86	76
pH		3.8	3.8	3.7	3.9	4.0	4.0	4.0
% SS (measured)		57.0	68.0	79.0	65.0	68.0	79.0	83.0

Table VII

Test results for examples 7.2 to 7.4, glazings

		Ex. 7.2	Ex. 7.3	Ex. 7.4
% SS		70.7	75.7	80.7
Sucrose:Non sucrose		30:70	35:65	40:60
DE of non sucrose		62	62	62
TA.XT2 measurements in Bloom glasses				
Gel strength	2 mm (g)	93	93	35
	4 mm (g)	185	238	112
	8 mm (g)	181	239	333
BS (g)		274	347	444

Example 8

Further test results were obtained, in which gelled soft candies (wine gums) were prepared essentially as described in the above examples 1.1. to 4.4, using GENUTI-NE™ X-9303 carrageenan at a fixed amount of 2.5%, but varying the weight ratios of sucrose and non-sucrose sweeteners, the DE values of the non sucrose sweetener, and the % SS values.

The characteristics of the different preparations were then determined, and the test results are listed in Table VIII below. Also, the corresponding data (G', G", and viscosity) are shown in Figs 1.1 to 1.9.

Viscosity (mPa·s), elastic modulus G' (Pa), and viscous modulus G" (Pa) were plotted as a function of the temperature in Figs 1.1-1.9. The data were obtained,

04.05.2001

using a Haake rheometer.

The gelation temperature of each composition is read from each of the Figs 1.1 to 1.9 as the temperature at which the respective G' curve and the G" curve intersects.

All the compositions tested resulted in gelation temperatures below 95° C, water activities above 0.65 and springiness values above 30 (Table VIII).

04.05.2001

Table VIII

Ex. No	Use level	Carrageenan	Gelation temp. (°C)	Deposit temp.	Viscosity at 95°C	Syrup: sugar	Syrup type	DE	% Soluble solids	Aw	Springiness %
8.1	2.5	GENUTINE™ X-9303	81.1	75	2788	4:1	HM 70	DE 54	79(81)	0.705	48.1
8.2	2.5	GENUTINE™ X-9303	71.3	71	1455	2:1	HM 70	DE 54	76		49.4
8.5	2.5	GENUTINE™ X-9303	73.5	71	796	2:1	HM 70	DE 54	73		
8.7	2.5	GENUTINE™ X-9303	78.3	80	2019	4:1	HM 70	DE 54	76	0.724	41.2
8.8	2.5	GENUTINE™ X-9303	85.5	81	3862	5:95	HM 70	DE 54	78.5	0.673	31.1
8.9	2.5	GENUTINE™ X-9303	81.4	77	3212	100:0	HM 70	DE 54	79	0.718	52.6

it appears, all formulations tested gave satisfactory results in terms of gelation temperatures well below 95°C, and a springiness in the order 40-50 %.

Example 9

US 5,607,716 discloses a low fat confectionery gelled by the use of carrageenan. The confectionery according to US 5,607,716, however, does not possess the desired characteristics according to the present invention in terms of gelation temperature, ease of handling, and springiness.

In order to further verify this, tests were performed comparing compositions prepared according to the recipes of examples 6 and 8 of the US 5,607,716 patent.

The type of carrageenan used in this comparative test was GENUTINE™ X-9303 and the results are shown in table X and Fig 2 below, wherefrom the gelation temperature (intersection point of the G' and G" curves) is obtained.

The compositions were:

I. Composition prepared according to example 6 of US 5,607,716, however using 0.2% GENUTINE™ X-9303, and 87% SS.

II. Composition prepared according to example 8 of US 5,607,716, however using 0.6% GENUTINE™ X-9303, and 89% SS.

III. Composition prepared according to example 6 of US 5,607,716, increasing the amount of GENUTINE™ X-9303 to 2.5%, the amount presently preferred according to the present invention, and reducing the SS content to 75%.

IV. Composition prepared according to example 8 of US 5,607,716, increasing the amount of GENUTINE™ X-9303 to 2.5% and reducing the SS content to 75%.

V. Composition prepared according to the present invention containing 2.5%

GENUTINE™ X-9303, 79% SS, a sucrose:non sucrose ratio of 1:4, and a DE 54 of the non-sucrose sweetener.

VI. Composition prepared as in V with 5% evaporated skim milk added.

For details on the composition, see Table IX below. The results obtained are given in Table X.

Tabel IX

Ingredients / Sample	I	II	III	V	VI
Evaporated Skim Milk	36.55	34.86	31.71		6.39
Di-sodium phosphate	0.06	0.01	0.06		
Tri-sodium citrate				0.46	0.46
High Fructose syrup, 55% fructose	61.04	58.24	52.98		
High Maltose syrup, Cargill HM70				68.81	63.25
Sugar				13.76	13.80
Butter		4.00			
Butter flavour	0.15		0.15		
AVICEL GP 3252	1.00	1.00	1.00		
Water		0.30	10.60	13.76	13.80
GENUTINE™ X-9303	0.20	0.60	2.50	2.29	2.30
NaCl	0.50	0.50	0.50		
Lecithin	0.20	0.19	0.20		
K-2000 (mono- and diglycerides)	0.30	0.30	0.30		
Citric acid (50% w/v solution)				0.92	
Total	100.00	100.00	100.00	100.00	100.00

04.05.2001

Table X

Composition	Appearance	Deposition-able	Gelation temp. (°C)	Viscosity at 95° C	Springiness
I	Thick, uneven	Yes	> 95	~ 20.000	< 10
II	Very thick, uneven	No	> 95	~ 100.000	< 15
III	Thick, very uneven, inhomoge-neous	No	> 95	> 100.000	28
*IV	-	-	-	-	-
V	Thin, even, homoge-neous	Yes	81	~ 2.800	48
VI	Even, homoge-neous	Yes	90	~ 10.000	35

*This composition was not possible to make.

This test shows (Table X) that the recipe given in Examples 6 and 8 of US 5,607,716 will not result in a composition with the desired gelation temperature below 95° C, neither if the carrageenan is used in 0.2 to 0.6% amounts (see I and II), nor if the amount is increased to 2.5% (see III and IV). Only the sweetening system used according to this invention (see V and VI) will result in a product with the desired characteristics.

04.05.2001

It is evident from the above results that the composition according to the invention (V) has the desired gelation temperature below 95° C, is easier to work with and has more springy characteristics.

The above description of the invention reveals that it is obvious that it can be varied in many ways. Such variations are not to be considered a deviation from the scope of the invention, and all such modifications which are obvious to persons skilled in the art are also to be considered comprised by the scope of the succeding claims.

Claims

1. A food composition comprising soluble solids in the range of about 50% to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE (Dextrose Equivalent) of about 50 to about 90, a carrageenan component in an amount sufficient to form a gel, and water to balance, and wherein the gelation temperature, determined as the intersection of the graphs of elastic modulus ,G', and viscous modulus, G", of said food composition is < 95° C.

2. The composition according to claim 1, wherein said non sucrose sweetener is a hydrogenated starch hydrolysate syrup with a DE in the range of about 60 to 70.

3. The composition according to claim 1, wherein said non sucrose sweetener is a high maltose glucose syrup, particularly a high maltose glucose syrup of a DE of about 50 to 60.

4. The composition according to claim 1, wherein the sucrose can be replaced wholly or partly by an aqueous solution of a sugar alcohol.

5. The composition according to claim 4, wherein said sugar alcohol is selected among sorbitol, mannitol, xylitol, isomalt, lactitol, maltitol or a maltitol syrup.

6. The composition according to any one of the claims 1 to 5, wherein the ratio of sucrose to non sucrose sweetener is from about 10:90 to about 70:30, preferably from about 20:80 to about 30:70, particularly preferred about 1:2.

7. The composition according to claim 1, wherein the soluble solids thereof is in the range of 70 to 85% by weight, particularly preferred about 75 to 80% by weight.

04.05.2001

8. The composition according to claim 1, wherein the gelation temperature of said food composition is less than 85° C, preferably less than 80° C.

9. The food composition according to claim 1, wherein at least about 80%, preferably at least about 90% of the soluble solids are comprised by said sweetening system.

10. The composition according to claim 1, wherein said carrageenan component is an iota carrageenan or a kappa carrageenan or mixtures thereof.

11. The composition according to claim 10, wherein said carrageenan is present in an amount of about 0.25 to 10.0% by weight, preferably about 0.75 to 5.0%, especially about 1 to 3% by weight of the food composition.

12. The composition according to claim 1 further comprising as additional gelling agent a hydrocolloid selected from the group comprising pectin, agar-agar, alginates, carboxy methyl cellulose, methyl cellulose, hydroxy propyl cellulose, curdlan, xanthans, gelatine, starch and gum arabic in an amount of up to about 10.0% by weight of the food composition.

13. The composition according to claim 1, wherein said soluble solids further comprise one or more ingredients selected among milk solids, vitamins, minerals, food grade acids and salts thereof, flavourings, colourings, artificial sweeteners, preservatives and bulking agents.

14. The composition according to claim 1, wherein said food composition is a high sugar confectionery.

15. The composition according to claim 14, wherein said food composition is soft candies or wine gum.

16. The composition according to claim 1, wherein said composition is an aerated confectionery and further comprises a whipping agent.

17. The composition according to claim 1, wherein said composition is a glazing.

18. A process for producing a food composition according to claim 1 comprising (a) dispersing carrageenan in a syrup of a non sucrose sweetener at a temperature sufficient to disperse the carrageenan in said syrup while stirring, (b) adding water and heating the mixture to the boiling point thereof, (c) adjusting the soluble solids content to from about 50% to about 90% by weight, (d) depositing said mixture and (e) cooling said mixture to below the depositing temperature of said mixture.

19. The process according to claim 18, wherein sucrose, if any, is added in step (c).

20. The process according to any one of the claims 18 to 19, wherein the temperature sufficient to disperse the carrageenan in the syrup of the non sucrose sweetener is at least about 50, especially at least about 60° C.

21. The process of any one of the claims 18 to 20, wherein one or more ingredients selected among milk solids, vitamins, minerals, food grade acids, flavourings, colourings, artificial sweeteners, preservatives and bulking agents is (are) added between steps (c) and (d).

22. The process according to any one of the claims 18 to 21, wherein in step (d) said hot mixture is deposited in moulds.

23. A use of a carrageenan component for gelling a food composition of a soluble solids content of about 50 to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweet-

ener is of a DE of about 50 to 90, and wherein the gelation temperature of said food composition is $\leq 95°$ C.

24. The use according to claim 23, wherein said carrageenan is an iota carrageenan or a kappa carrageenan or mixtures thereof.

App. I (1)

CPKelco

Hersh y patent caramel example 1

- Dissolving carrageenan in milk solids/water

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Hershey patent caramel example 1

- Viscosity at 116 °C

App I (2)

CPKelco

Hersh y patent caramel example 1

- Viscosity at 100 °C

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Hershey patent caramel example 1

- Viscosity at 95 °C

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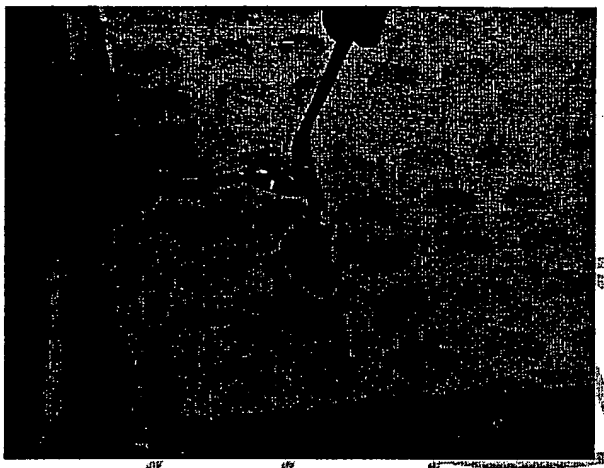
Hersh y patent caramel example 1

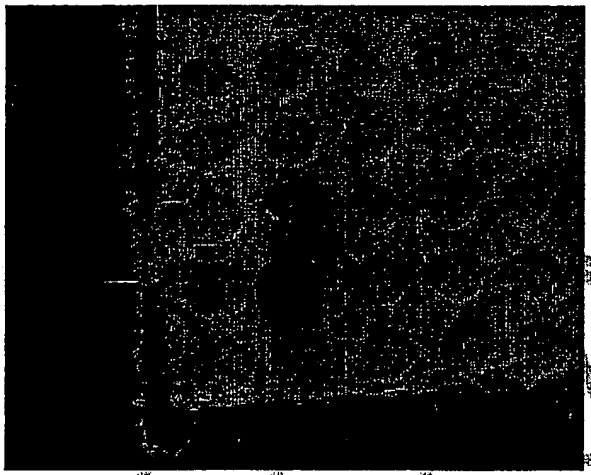
- Depositing at 95 °C in starch moulds



CPKelco

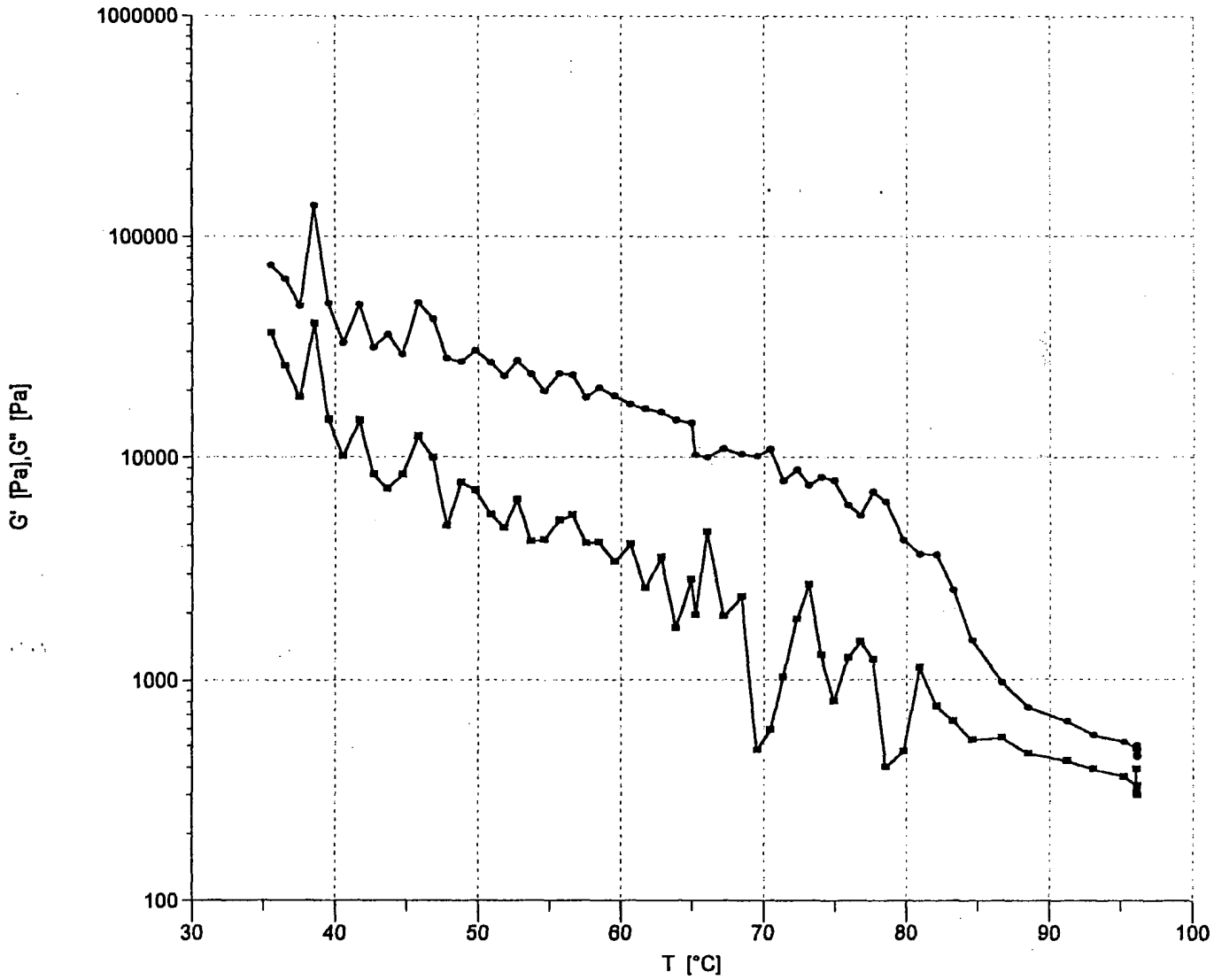
Hershey patent caramel example 1

- Final product



Caramel example 1. Hersney Patent

5-36
G' = f (T)
G" = f (T)



AKE RheoWin Pro 2.70

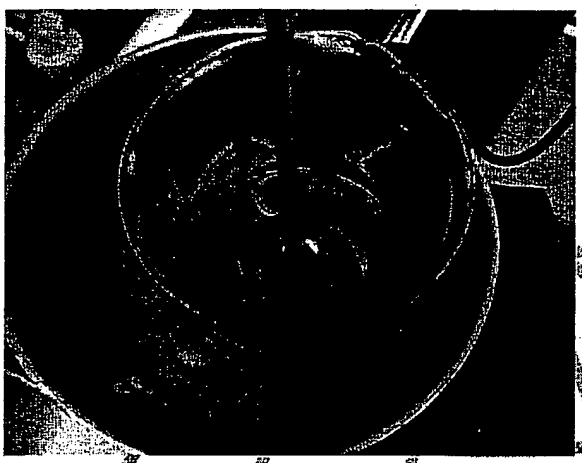
Page 4 (4)

App. II (1)

CPKelco

Ch wable carrag enan confection - example 1

- Hydration of carrageenan in water



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Chewable carrageenan confection - example 1

- Evaporation of water to 79% solids

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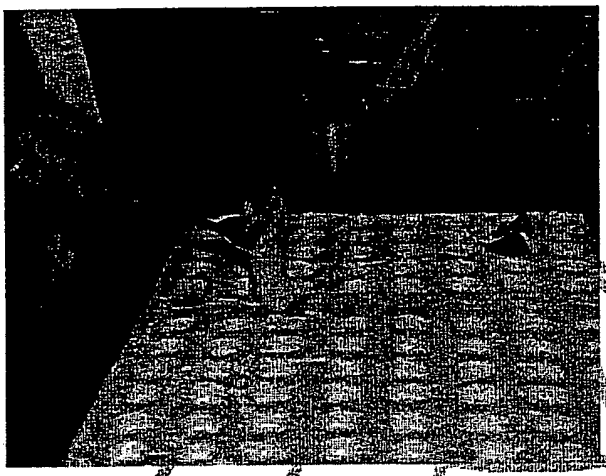
App. II (2)

CPKelco

Chewabl carrage nan confection - example 1

- Depositing of product at 102 °C



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CPKelco

Chewable carrageenan confection - example 1

- Final product

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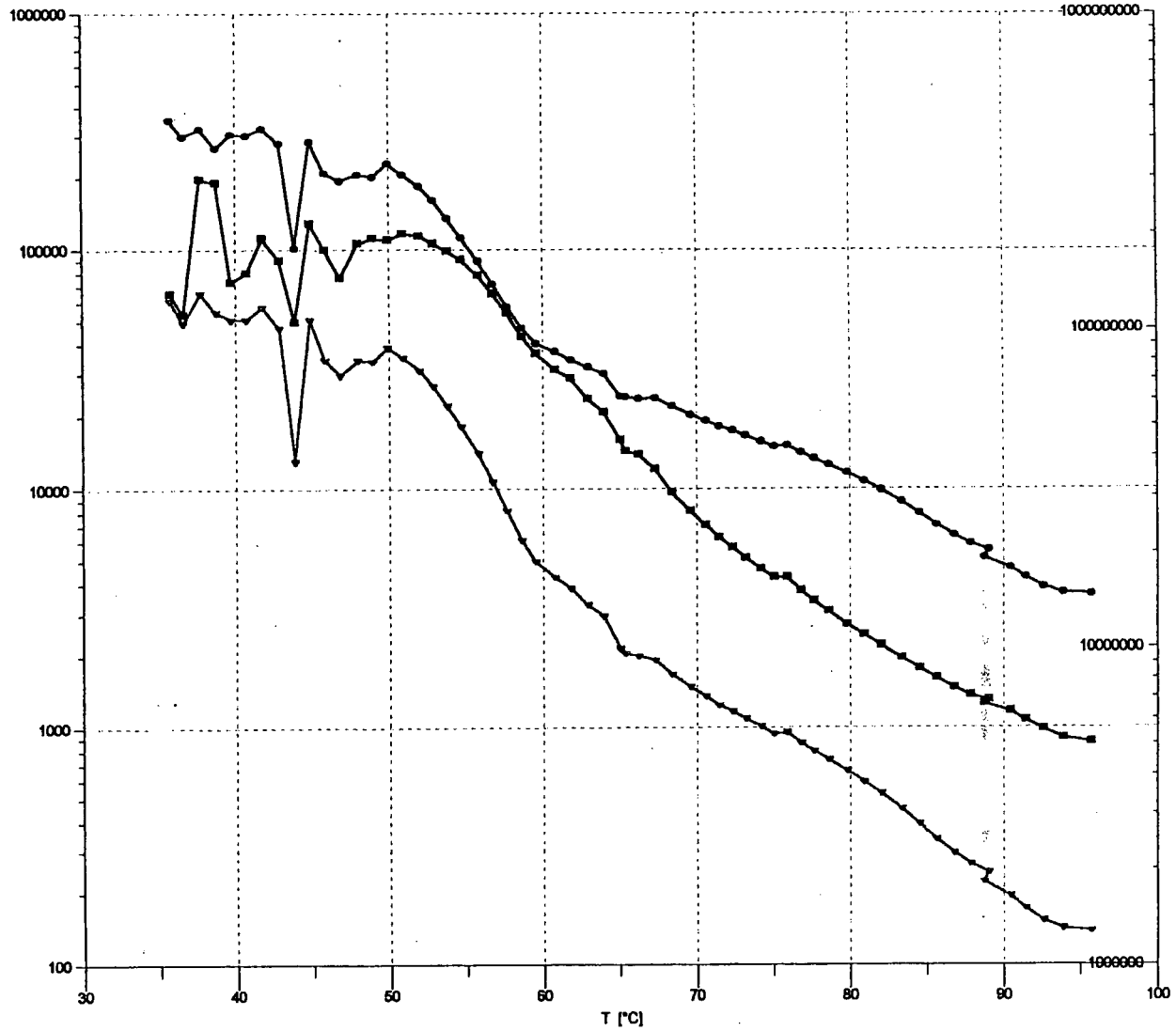
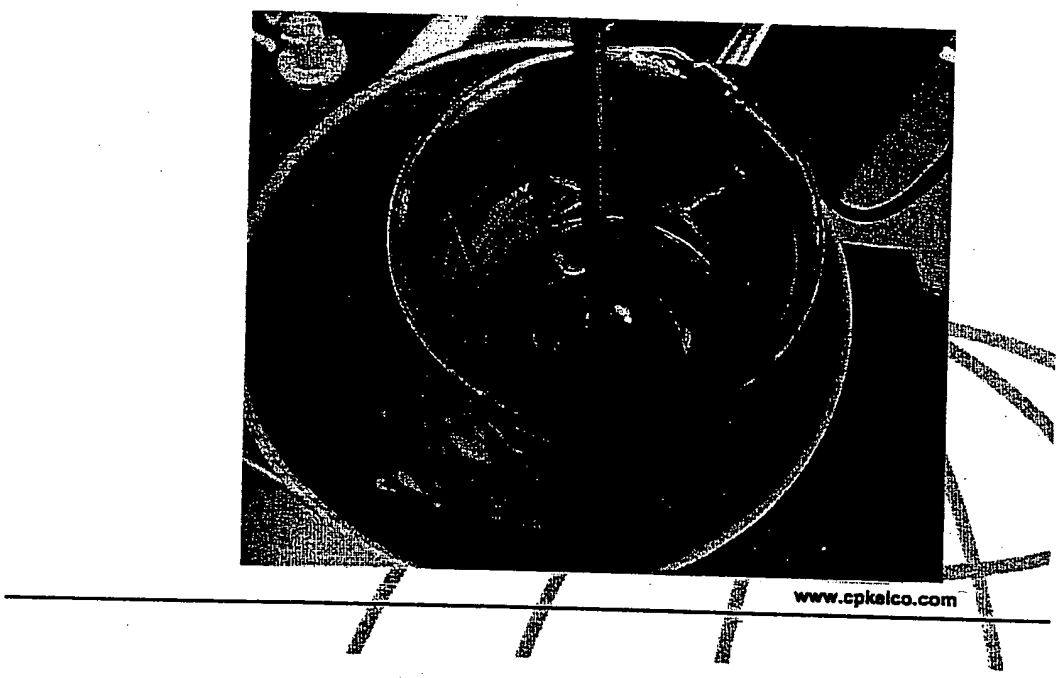
25-38
- G' = f (T)
- G" = f (T)
- |η*| = f (T)



Chewable carrageenan confection - example 1

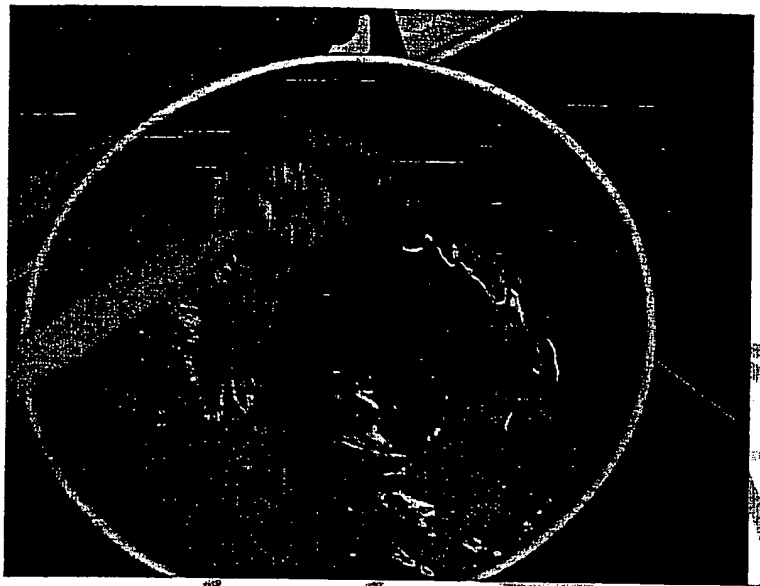
- Hydration of carrageenan in water



App. III (2)

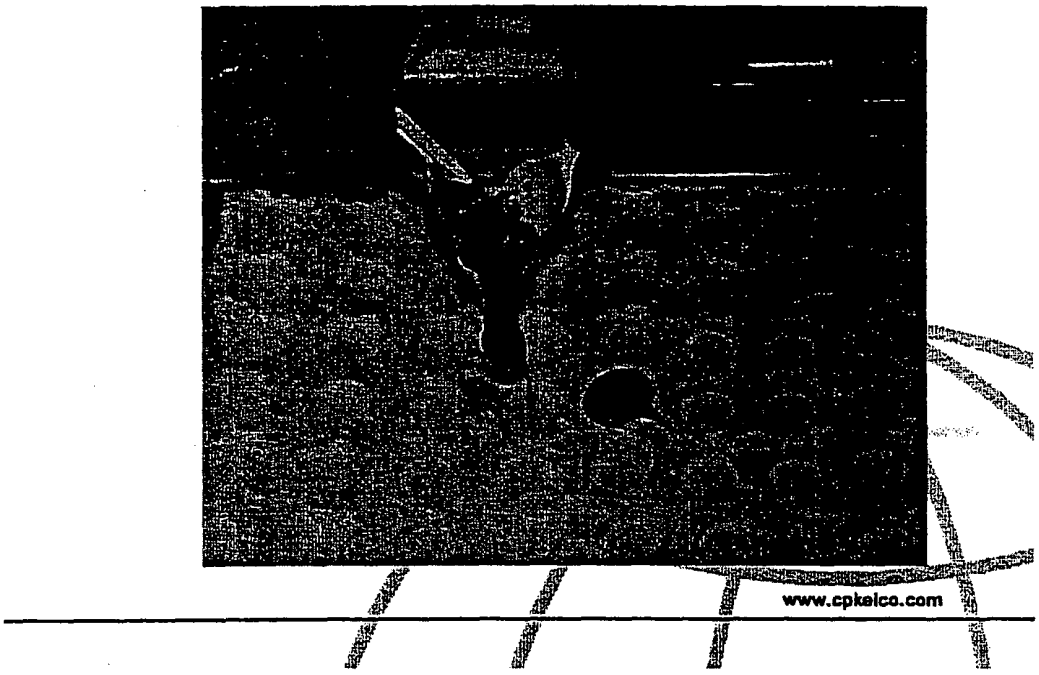
Chewable carrageenan confection - no calcium carbonate example 1

- **Evaporation of water to 79% solids**

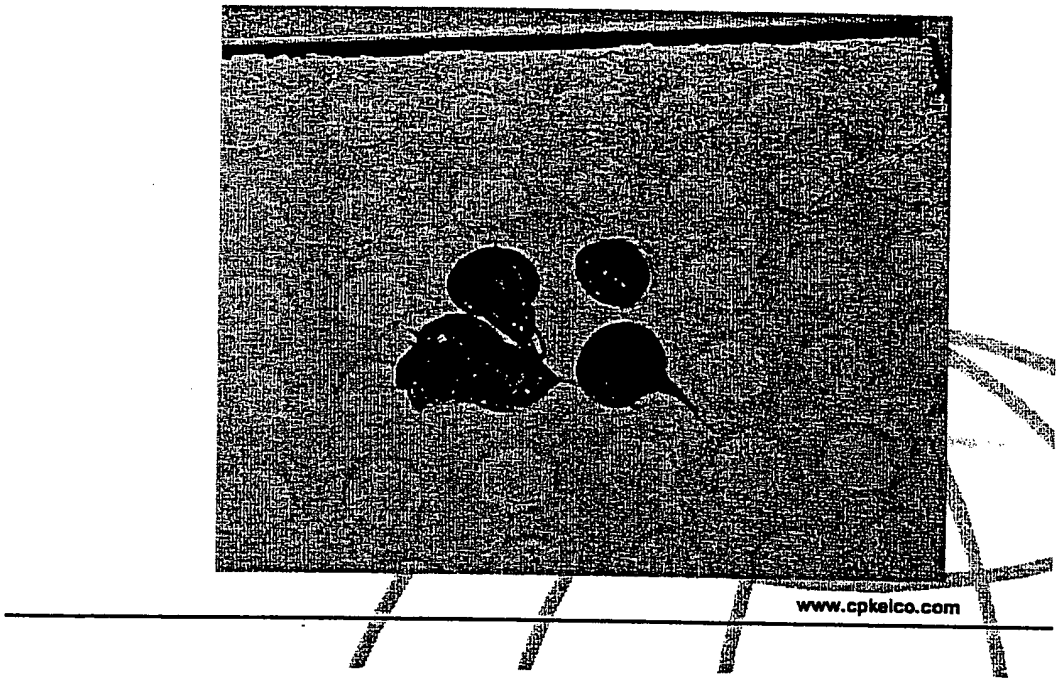


Chewable carrageenan confection - no calcium carbonate example 1

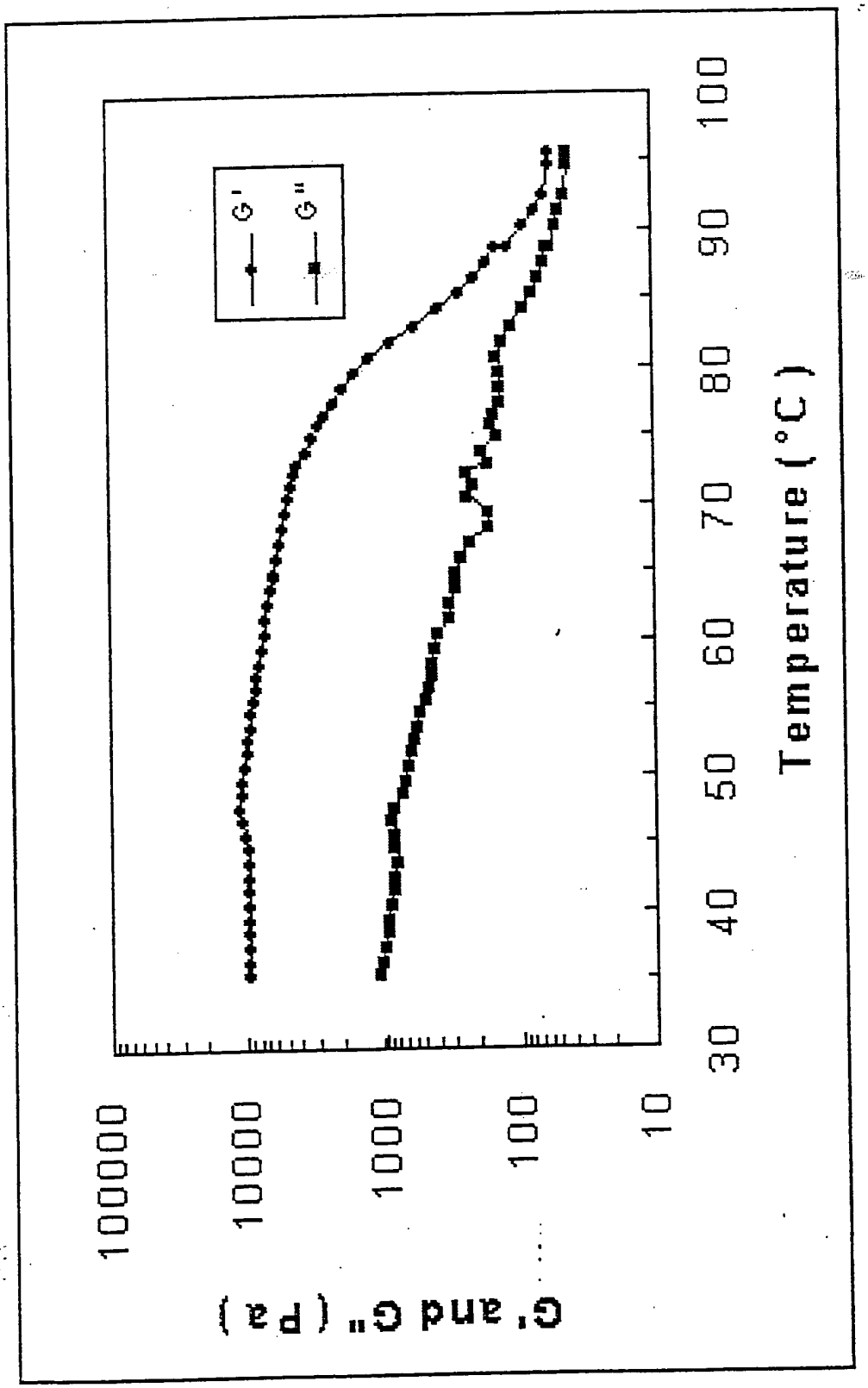
- **Depositing at 98 C**



➢ Final product



App. II (S)


G' and G" (Pa)
100000
10000
1000
100
10
30
40
50
60
70
80
90
100
Temperature (°C)
G'
G"

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Att: Ms. Judith Graham

VIA TELEFAX NO. 0049 89 2399 4465

2 August 2001

Dear Ms. Graham

PCT-application No. PCT/DK00/00252
Applicant: Hercules Incorporated
My ref: 72201 UCK/Sp

With reference to our telephone conversation of 1 August 2001 I hereby transmit a new set of claims amended as agreed upon during said telephone conversation.

Thus, claims 1 and 25 have been clarified by adding the settings used for the rheology measurements. Furthermore, claims 1 and 25 have been amended to specify that the DE of the non-sucrose sweetener is at least 30, the limitation to a DE of at least 50 being unnecessary. In view hereof, former subclaims 2 - 4 have been reintroduced and the remaining claims have been renumbered.

Corresponding amendments have been made in the description.

Finally, I can inform you that in the comparative examples forwarded with my reply to the Written Opinion dated 4 May 2001 the same settings of the rheology measurements as used in the application were applied.

Yours faithfully
CHAS. HUDE A/S

Ulla C. Klinge
Representative of the Applicant

Encs:
amended claims
draft showing amendments in the description

Claims

1. A food composition comprising soluble solids in the range of about 50% to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE (Dextrose Equivalent) of at least about 30, a carrageenan component in an amount sufficient to form a gel, and water to balance, and wherein the gelation temperature, determined as the intersection of the graphs of elastic modulus ,G', and viscous modulus, G", measured on a Haake Rheometer, RS 100 using the settings - Gradient 1 °C/min, 0,4640 Hz, 95°C - 65°C, t=1800 s, 0,50 Pa, 65°C - 35°C, t=1800 s, 2,50 Pa - Stress sweep 35 °C 0,10 Pa- 20,00 Pa, 0,4640 Hz, of said food composition is < 95° C.

2. The composition according to claim 1, wherein said non sucrose sweetener is a hydrogenated starch hydrolysate syrup of a DE of at least about 30, preferably a DE > 30 fructose or glucose syrup.

3. The composition according to claim 1, wherein said non sucrose sweetener is a hydrogenated starch hydrolysate syrup of a DE of least about 40, preferably a DE > 40 fructose or glucose syrup.

4. The composition according to claim 1, wherein said non sucrose sweetener is a hydrogenated starch hydrolysate syrup with a DE in the range of about 40 to about 100, particularly preferred about 50 to 90, especially about 60 to 70.

5. The composition according to claim 4, wherein said non sucrose sweetener is a high maltose glucose syrup, particularly a high maltose glucose syrup of a DE of about 50 to 60.

6. The composition according to claim 1, wherein the sucrose can be replaced wholly or partly by an aqueous solution of a sugar alcohol.

7. The composition according to claim 6, wherein said sugar alcohol is selected among sorbitol, mannitol, xylitol, isomalt, lactitol, maltitol or a maltitol syrup.

8. The composition according to any one of the claims 1 to 7, wherein the ratio of sucrose to non sucrose sweetener is from about 10:90 to about 70:30, preferably from about 20:80 to about 30:70, particularly preferred about 1:2.

9. The composition according to claim 1, wherein the soluble solids thereof is in the range of 70 to 85% by weight, particularly preferred about 75 to 80% by weight.

10. The composition according to claim 1, wherein the gelation temperature of said food composition is less than 85° C, preferably less than 80° C.

11. The food composition according to claim 1, wherein at least about 80%, preferably at least about 90% of the soluble solids are comprised by said sweetening system.

12. The composition according to claim 1, wherein said carrageenan component is an iota carrageenan or a kappa carrageenan or mixtures thereof.

13. The composition according to claim 12, wherein said carrageenan is present in an amount of about 0.25 to 10.0% by weight, preferably about 0.75 to 5.0%, especially about 1 to 3% by weight of the food composition.

14. The composition according to claim 1 further comprising as additional gelling agent a hydrocolloid selected from the group comprising pectin, agar-agar, alginates, carboxy methyl cellulose, methyl cellulose, hydroxy propyl cellulose,

curdlan, xanthans, gelatine, starch and gum arabic in an amount of up to about 10.0% by weight of the food composition.

15. The composition according to claim 1, wherein said soluble solids further comprise one or more ingredients selected among milk solids, vitamins, minerals, food grade acids and salts thereof, flavourings, colourings, artificial sweeteners, preservatives and bulking agents.

16. The composition according to claim 1, wherein said food composition is a high sugar confectionery.

17. The composition according to claim 16, wherein said food composition is soft candies or wine gum.

18. The composition according to claim 1, wherein said composition is an aerated confectionery and further comprises a whipping agent.

19. The composition according to claim 1, wherein said composition is a glazing.

20. A process for producing a food composition according to claim 1 comprising (a) dispersing carrageenan in a syrup of a non sucrose sweetener at a temperature sufficient to disperse the carrageenan in said syrup while stirring, (b) adding water and heating the mixture to the boiling point thereof, (c) adjusting the soluble solids content to from about 50% to about 90% by weight, (d) depositing said mixture and (e) cooling said mixture to below the depositing temperature of said mixture.

21. The process according to claim 20, wherein sucrose, if any, is added in step (c).

22. The process according to any one of the claims 20 to 21, wherein the temperature sufficient to disperse the carrageenan in the syrup of the non sucrose sweetener is at least about 50, especially at least about 60° C.

23. The process of any one of the claims 20 to 22, wherein one or more ingredients selected among milk solids, vitamins, minerals, food grade acids, flavourings, colourings, artificial sweeteners, preservatives and bulking agents is (are) added between steps (c) and (d).

24. The process according to any one of the claims 20 to 23, wherein in step (d) said hot mixture is deposited in moulds.

25. A use of a carrageenan component for gelling a food composition of a soluble solids content of about 50 to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE of at least about 30, and wherein the gelation temperature of said food composition ,determined as the intersection of the graphs of elastic modulus, G', and viscous modulus, G", measured on a Haake Rheometer, RS 100 using the settings - Gradient 1 °C/min, 0,4640 Hz, 95 °C - 65 °C, t=1800 s, 0,50 Pa, 65 °C - 35 °C, t=1800 s, 2,50 Pa - Stress sweep 35 °C 0,10 Pa- 20,00 Pa, 0,4640 Hz, is < 95° C.

26. The use according to claim 25, wherein said carrageenan is an iota carrageenan or a kappa carrageenan or mixtures thereof.

viscosity during depositing in e.g. moulds, gels rapidly and can successfully be produced at temperatures not requiring special apparatuses or arrangements to be met.

In its first aspect, the present invention relates to a food composition comprising soluble solids in the range of 50% to 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE (Dextrose Equivalent) of at least about 30 a carrageenan component in an amount sufficient to form a gel, and water to balance, wherein the gelation temperature, determined as the intersection of the graphs of elastic modulus, G', and viscous modulus, G", of said composition is <-95°C measured on a Haake Rheometer, RS 100 using the settings - Gradient 1°C/min, 0,4640 Hz, 95°C - 65°C, t=1800 s, 0,50 Pa, 65°C - 35°C, t=1800 s, 2,50 Pa - Stress sweep 35 °C 0,10 Pa- 20,00 Pa, 0,4640 Hz.

The elastic modulus, G', indicates the solid behaviour of a gel, and is a measure of the gel strength, while the viscous modulus, G", indicates the liquid behaviour of the gel, which correlates to the degree of bounciness and trembling of the gel.

In a second aspect, the present invention provides a process for producing a food composition as defined above comprising (a) dispersing carrageenan in a syrup of a sucrose sweeetener at a temperature sufficient to disperse the carrageenan in said syrup while stirring, (b) adding water and heating the mixture to the boiling point thereof, (c) adjusting the soluble solids content to from about 50% to about 90% by weight, (d) depositing said mixture, and (e) cooling said mixture to below the depositing temperature of said mixture.

In all herein, the term "depositing temperature" means the lowest temperature, at which depositing is possible, i.e. at which temperature the food composition is still

In a preferred embodiment, the non sucrose sweetener is a hydrogenated starch hydrolysate syrup with a DE in the range of about 40 to about 100, particularly preferred about 50 to 90, especially about 60 to 70. A non sucrose sweetener with a maltose content ≥ 50% and a DE of about 50 to 60 is particularly preferred. Said embodiment provides the optimum characteristics in terms of sweetness level, texture and solubility of the gelled food composition.

In another embodiment of the present invention, the sucrose can be replaced wholly or partly by an aqueous solution of a sugar alcohol. Said sugar alcohol is preferably, but not exclusively, selected among sorbitol, mannitol, xylitol, isomalt, lactitol, maltitol or a maltitol syrup.

In a preferred embodiment of the present invention, the sweetening system comprises sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweetener of from about 10:90 to about 70:30, preferably from about 20:80 to about 30:70, particularly preferred about 1:2. Thus, it has been found that at the disclosed ratios, an acceptable sweetness level still providing a composition having a gelation temperature of < 95° C is obtained.

Particularly preferred, the gelation temperature of said food composition is < 85° C, preferably < 80° C.

The present invention is highly suitable for preparing gelled food compositions having high soluble solids content. In a preferred embodiment, said soluble solids content is in the range of 70 to 85% by weight, particularly preferred about 75 to 80% by weight.

Advantageously, at least about 80%, preferably at least about 90% of the soluble solids are comprised by the above sweetening system. Thus, it has been shown that even at such high concentrations of sweetening system a gelled product having a

satisfactory gelation temperature may be obtained.

As carrageenan component an iota carrageenan or a kappa carrageenan or mixtures thereof are employed, preferably in an amount of about 0.25 to 10.0% by weight, preferably about 0.75 to 5.0%, especially about 1 to 3% by weight of the food composition. Suitable carrageenans are commercially available as e.g. GENUTINE™ type X-8300, X-8302, and X-9303 from Hercules Copenhagen, Denmark, or GENUGEL™ type WR-713 or X-8605, likewise available from Hercules Copenhagen.

While the above carrageenans are the preferred ones, it must be understood that the invention is not limited thereto. Thus, any carrageenan component, which will provide the required gelling capability, may be employed in a food composition according to the present invention. More particularly, a carrageenan component in a non-purified form, such as in the form of seaweed, particularly red seaweeds, may also be employed.

Further, one or more additional hydrocolloids may be employed in combination with the above disclosed carrageenans to provide a particular gelling property, such as pectin, e.g. GENU™ Pectin, available from Hercules Copenhagen, agar-agar, e.g. GENU™ Agar, available from Hercules Copenhagen, cellulose, such as AVICEL™, cellulose extracts and derivatives such as carboxy methyl cellulose (CMC), e.g. Blanose cellulose gum, methyl cellulose, e.g. Benecel™, hydroxy propyl cellulose, e.g. Klucel, hydroxy propyl methyl cellulose and mixtures thereof, starch, such as Avebe ™ Perfectagel MPT, Avebe ™ Perfectagel 928 and Avebe ™ Perfectamyl Gel MB, alginates, xanthans such as Keltrol or Kelgum from Kelco Biopolymers, curdlan, gelatine, guar, locust bean gum, tara gum, karaya gum, gellan gum such as Kelcogel from Kelco Biopolymers, furcellaran, tragacanth, and gum arabic, generally in an amount of up to about 10% by weight.

The present invention also provides the use of a carrageenan component for gelling a food composition of a soluble solids content of about 50 to about 90% by weight, at least 70% by weight thereof being a sweetening system comprising sucrose and non sucrose sweeteners in a weight ratio of sucrose to non sucrose sweeteners of 0:100 to 95:5, wherein the non sucrose sweetener is of a DE of at least about 30, and wherein the gelation temperature of said composition determined as the intersection of the graphs of elastic modulus, G', and viscous modulus, G", measured on a Haake Rheometer, RS 100 using the settings - Gradient 1°C/min, 0,4640 Hz, 95°C - 65°C, t=1800 s, 0,50 Pa, 65°C - 35°C, t=1800 s, 2,50 Pa - Stress sweep 35 °C 0,10 Pa-20,00 Pa, 0,4640 Hz, is below 95°C. The carrageenan component is preferably an iota carrageenan or a kappa carrageenan or mixtures thereof.

Thus, a vegetable alternative to gelatine has been provided giving a product of a similar texture as gelatine gelled products and which allows the preparation of food compositions of high soluble solids content in a cost and energy efficient, industrially applicable process.

Examples

In the examples given below the following apparatus and chemicals have been used to prepare and test food compositions according to the invention:

Apparatus:

- Texture Analyzer, TA-XT2. 5 kg. Software Texture Expert™, manufactured by Stable Micro Systems, England.

Chemicals:

- Sucrose, food grade, Danisco A/S, Denmark

- Citric acid, monohydrated, MERCK in 50% w/v solution
- Tri-sodium citrate, $2H_2O$, MERCK
- GENUTINE™ types X-8302, X-8300, and X-9303 carrageenan, Hercules

Table VIII

Ex. No	Use level	Carrageenan	Gelation temp. (°C)	Deposit temp.	Viscosity at 95°C	Syrup! sugar	Syrup type	DE	% Soluble solids	Aw	Springiness %
8.1	2.5	GENUTINE™ X-9303	81.1	75	2788	4:1	HM 70	DE 54	79(81)	0.705	48.1
8.2	2.5	GENUTINE™ X-9303	71.3	71	1455	2:1	HM 70	DE 54	76		49.4
8.3	2.5	GENUTINE™ X-9303	80.0	76	3293	2:1	Igos	DE 40	76		44
8.4	2.5	GENUTINE™ X-9303	74.2	70	974	2:1	Igos	DE 40	74		
8.5	2.5	GENUTINE™ X-9303	73.5	71	796	2:1	HM 70	DE 54	73		
8.6	2.5	GENUTINE™ X-9303	89.7	87	9699	4:1	Igos	DE 40	79.5	0.711	38.7
8.7	2.5	GENUTINE™ X-9303	78.3	80	2019	4:1	HM 70	DE 54	76	0.724	41.2
8.8	2.5	GENUTINE™ X-9303	85.5	81	3862	5:95	HM 70	DE 54	78.5	0.673	31.1
8.9	2.5	GENUTINE™ X-9303	81.4	77	3212	100:0	HM 70	DE 54	79	0.718	52.6

it appears, all formulations tested gave satisfactory results in terms of gelation temperatures well below 95°C, and a springiness in the order 40-50 %.